Plywood in Aeroplane Construction

THE first point upon which stress is laid in this article, describing the many uses to which plywood may with advantage be put, is that the idea of a number of sheets and fragments of thin wood stuck together by an adhesive such as ordinary glue, more or less soluble in water, or swelling and loosening on exposure to atmospheric humidity, should be dismissed from the mind when the material "plywood" is under consideration.

True plywood is a product resulting from a scientific process involving a correct and methodical sequence of operations all depending on each other. The elements of the original structure of the wood; the relations of the particular cementing material employed to the wood and to the atmospheric conditions of the moment; the temperature required to produce the chemical reactions between the wood and the cementing material, and within the cementing material itself; and the magnitude and duration of the pressure applied per unit area; all these form such a number of variables that no routine standardisation is practicable, and only the exercise of individual skill obtained under long experience, can produce a determinate result.

Laminated plywood formed into shapes under heat and high pressure with cementing materials which become insoluble in the course of the process, has been used in Russia for many years, notably in the works of the Russian Baltic Wagon Co., Ltd., who made the plywood fuselage of the first Sikorsky aeroplane. From Russia the use of plywood extended to Germany in the products of the Deutsches Rohrplatten Gesellschaft; from which a knowledge of these special processes and equipment passed to the United States nearly twenty years ago. In Russia Capt. Kostovitch used plywood for dirigibles which in construction and design anticipated the most recent rigid plywood dirigibles built by the Schutte-Lanz Company in Germany. In Russia also the first complete plywood aeroplanes were made by Steglau in 1912, the use of plywood extending even to the wing covering.

In France, as early as 1909, sheet plywood was used by Levavasseur, and later, in 1912, Béchereau, of the Deperdussin Company, designed the fuselage now known as the "monocoque."

The Germans, who at first made fuselages of the truss type, covered in with linen after the prevailing French style, commenced about 1912—probably following on a visit of one of their investigators to Russia—to use plywood in fuselage construction, following not the method of Béchereau but a more correct method employing longerons and bulkheads.

England and France continued to use the linen-covered truss construction, and the designers of the United States in most cases followed the precedents thus created with little or no regard to what had been developed in Russia and Germany.

It is pointed out what rough usage the fuselage of the Albatross aeroplanes are able to withstand, and that the use of plywood on British and French machines is even yet unlike that of the better-constructed German aeroplanes in that the plywood is generally nailed on as a mere covering, and not made an integral part of the structure.

Among the advantages of plywood as against the truss construction are the facts that no periodical truing up is required, and that the wood for plywood being so thin may be dried very quickly. The real problem in its successful use in aeroplane construction lies in the standardisation of parts for quantity production.—*H. H. Suplee, Acrial Age Weekly.*

Applications of Kirchoff's Law

THIS is a short article giving some practical applications of the laws of Kirchoff. It is a simple matter by Ohm's laws to find the current passing through a circuit supplied from two or more equal electromotive forces and equal internal resistances connected in parallel. If on the other hand the two or more electromotive forces are unlike with unequal internal resistances and connected in parallel, Kirchoff's laws must be resorted to.

By Kirchoff's first law the algebraic sum of the currents meeting at any point is zero, and by the second law the algebraic sum of the products of the current and resistance of each part of a series circuit equals the electromotive force of that circuit.

If a generator has an open circuit voltage of $E_1 = 120$ volts and an internal resistance of 0.2 ohms while a storage battery develops a voltage $E_2 = 110$ volts on open circuit and has an internal resistance of 0.3 ohms, both generator and battery being connected in parallel to an external circuit r^3 of 2 ohms resistance, it is impossible to tell by inspection whether the generator will charge the battery or the battery discharge through the external circuit r^3. This must be determined and also what the voltage across the circuit will be when the current is flowing.

If the battery is being charged the questionable current would have a negative value, indicating that the battery is aiding the generator by discharging through r^3. From the figures and formulæ given it is shown that this value is —1.898 amperes, and from this it may be calculated that the voltage $E = 109.436$ volts by three different methods which are given.

The same problem may be worked out by a different method, in which it is assumed that the generator current $= x$, and the battery current $= y$, then the current passing through the circuit $r^3 = x - y$. The working out of the problem by this second method is a check upon the first. The effect of armature reaction in reducing the generated voltage is not taken into account in the calculations given, but for an interpole machine the effect is negligible.—*Kubanyi, Power.*

Discharges of Atmospheric Electricity

THIS article deals with the records for Zurich and neighborhood of severe storms with thunder and lightning. The earliest observer was Wolfgang Haller, who kept records between 1550 and 1576; a later observer was Prof. Fries, whose records cover the period 1683 to 1718, and since 1821 official records have been kept, while since 1864 the meteorological office has published returns.

A table gives the results. The storms averaged 15.1 per annum for the period 1821-1840; 16.8 for 1841-1860; 16.4 for 1861-1880; 22.3 for 1881-1900 and 18.3 for 1901-1918. It had been suggested that the extended use of high tension conductors of electricity carried upon poles might have considerably modified the number of electric storms, but the author is satisfied that this theory is disproved by the official records. He considers that the seat of the atmospheric discharge is at far too great an elevation above the earth to be affected by electric conductors. He also points out that the percentage of deaths from lightning have remained practically constant.—*Schweizerische Bauzeitung.*

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